

SEQUENCE LISTING

(1) GENERAL INFORMATION:

(i) APPLICANT: Donson, Jon  
Dawson, William O.  
Grantham, George L.  
Turpen, Thomas H.  
Turpen, Ann Myers  
Garger, Stephen J.  
Grill, Laurence K.

(ii) TITLE OF INVENTION: RECOMBINANT PLANT VIRAL  
NUCLEIC ACIDS

(iii) NUMBER OF SEQUENCES: 11

(iv) CORRESPONDENCE ADDRESS:  
(A) ADDRESSEE: Limbach & Limbach  
(B) STREET: 2001 Ferry Building  
(C) CITY: San Francisco  
(D) STATE: CAL  
(F) ZIP: 94111

(v) COMPUTER READABLE FORM:  
(A) MEDIUM TYPE: Floppy disk  
(B) COMPUTER: IBM PC compatible  
(C) OPERATING SYSTEM: PC-DOS/MS-DOS  
(D) SOFTWARE: Patent in Release #1.0,  
Version #1.25

(vi) CURRENT APPLICATION DATA:

(A) APPLICATION NUMBER:  
(B) FILING DATE:  
(C) CLASSIFICATION:

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER: US 600,244  
(B) FILING DATE: 22-OCT-1990

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER: US 641,617  
(B) FILING DATE: 16-JAN-1991

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER: US 310,881  
(B) FILING DATE: 17-FEB-1989

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER: US 160,766  
(B) FILING DATE: 26-FEB-1988

(vii) PRIOR APPLICATION DATA:

(A) APPLICATION NUMBER: US 160,771  
(B) FILING DATE: 26-FEB-1988

- Paul D1*
- (vii) PRIOR APPLICATION DATA:
    - (A) APPLICATION NUMBER: US 347,637
    - (B) FILING DATE: 05-MAY-1989
  - (vii) PRIOR APPLICATION DATA:
    - (A) APPLICATION NUMBER: US 363,138
    - (B) FILING DATE: 08-JUN-1989
  - (vii) PRIOR APPLICATION DATA:
    - (A) APPLICATION NUMBER: US 219,279
    - (B) FILING DATE: 15-JUL-1988
  - (viii) ATTORNEY/AGENT INFORMATION:
    - (A) NAME: Halluin, Albert P.
    - (B) REGISTRATION NUMBER: 28,957
    - (C) REFERENCE/DOCKET NUMBER: BIOG-20121 USA
  - (ix) TELECOMMUNICATION INFORMATION:
    - (A) TELEPHONE: 415-433-4150
    - (B) TELEFAX: 415-433-8716
  - (2) INFORMATION FOR SEQ ID NO: 1:
  - (i) SEQUENCE CHARACTERISTICS:
    - (A) LENGTH: 4 amino acids
    - (B) TYPE: amino acid
    - (D) TOPOLOGY: linear
  - (ii) MOLECULE TYPE: peptide
  - (iii) HYPOTHETICAL: NO
  - (iv) ANTI-SENSE: NO
  - (xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

Pro Xaa Gly Pro  
1

- (2) INFORMATION FOR SEQ ID NO: 2:
- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 13 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: DNA (genomic)
- (iii) HYPOTHETICAL: NO

(iv) ANTI-SENSE: NO

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

GGGTACCTGG GCC

13

(2) INFORMATION FOR SEQ ID NO: 3:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 886 base pairs

(B) TYPE: nucleic acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

(iii) HYPOTHETICAL: NO

(iv) ANTI-SENSE: NO

(vi) ORIGINAL SOURCE:

(A) ORGANISM: Chinese cucumber

(vii) IMMEDIATE SOURCE:

(B) CLONE: alpha-trichosanthin

(ix) FEATURE:

(A) NAME/KEY: CDS (B) LOCATION: 8. .877

(B) LOCATION: 8. .877

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

CTCGAGG ATG ATC AGA TTC TTA GTC CTC TCT TTG CTA ATT CTC ACC CTG 49

Met Ile Arg Phe Leu Val Leu Ser Leu Leu Ile Leu Thr Leu  
1 5 10

TTC CTA ACA ACT CCT GCT GTG GAG GGC GAT GTT AGC TTC CGT TTA TCA 97

Phe Leu Thr Thr Pro Ala Val Glu Gly Asp Val Ser Phe Arg Leu Ser  
15 20 25 30

GGT GCA ACA AGC AGT TCC TAT GGA GTT TTC ATT TCA AAT CTG AGA AAT 145

Gly Ala Thr Ser Ser Ser Tyr Gly Val Phe Ile Ser Asn Leu Arg Lys  
35 40 45

GCT CTT CCA AAT GAA AGG AAA CTG TAC GAT ATC CCT CTG TTA CGT TCA 193

Ala Leu Pro Asn Glu Arg Lys Leu Tyr Asp Ile Pro Leu Leu Arg Ser

50 55 60

TCT CTT CCA GGT TCT CAA CGC TAC GCA TTG ATC CAT CTC ACA AAT TAT 41  
Ser Leu Pro Gly Ser Gln Arg Tyr Ala Leu Ile His Leu Thr Asn Tyr  
65 70 75

GCC GAT GAA ACC ATT TCA GTG GCC ATA GAC GTA ACG AAC GTC TAT AT 39  
Ala Asp Glu Thr Ile Ser Val Ala Ile Asp Val Thr Asn Val Tyr Ile  
80 85 90

ATG GGA TAT CGC GCT GGC GAT ACA TCC TAT TTT TTC AAC GAG GCT TCT 37  
Met Gly Tyr Arg Ala Gly Asp Thr Ser Tyr Phe Phe Asn Glu Ala Ser  
95 100 105 110

GCA ACA GAA GCT GCA AAA TAT GTA TTC AAA GAC GCT ATG CGA AAA GT 35  
Ala Thr Glu Ala Ala Lys Tyr Val Phe Lys Asp Ala Met Arg Lys Val  
115 120 125

ACG CTT CCA TAT TCT GGC AAT TAC GAA AGG CTT CAA ACT GCT GCG GGT 33  
Thr Leu Pro Tyr Ser Gly Asn Tyr Glu Arg Leu Gln Thr Ala Ala Gly  
130 135 140

AAA ATA AGG GAA AAT ATT CCG CTT GGA CTC CCA GCT TTG GAC AGT GGT 31  
Lys Ile Arg Glu Asn Ile Pro Leu Gly Leu Pro Ala Leu Asp Ser Ala  
145 150 155

ATT ACC ACT TTG TTT TAC TAC AAC GCC AAT TCT GCT GCG TCG GCA CT 29  
Ile Thr Thr Leu Phe Tyr Tyr Asn Ala Asn Ser Ala Ala Ser Ala Leu  
160 165 170

ATG GTA CTC ATT CAG TCG ACG TCT GAG GCT GCG AGG TAT AAA TTT AT 17  
Met Val Leu Ile Gln Ser Thr Ser Glu Ala Ala Arg Tyr Lys Phe Ile  
175 180 185 190

GAG CAA CAA ATT GGG AAG CGC GTT GAC AAA ACC TTC CTA CCA AGT TT 25  
Glu Gln Gln Ile Gly Lys Arg Val Asp Lys Thr Phe Leu Pro Ser Leu  
195 200 205

GCA ATT ATA AGT TTG GAA AAT AGT TGG TCT GCT CTC TCC AAG CAA AT 13  
Ala Ile Ile Ser Leu Glu Asn Ser Trp Ser Ala Leu Ser Lys Gln Ile  
210 215 220

CAG ATA GCG AGT ACT AAT AAT GGA CAG TTT GAA ACT CCT GTT GTG CTG 21  
 Gln Ile Ala Ser Thr Asn Asn Gly Gln Phe Glu Thr Pro Val Val Leu  
 225 230 235  
 ATA AAT GCT CAA AAC CAA CGA GTC ATG ATA ACC AAT GTT GAT GCT GGA 69  
 Ile Asn Ala Gln Asn Gln Arg Val Met Ile Thr Asn Val Asp Ala Gly  
 240 245 250  
 GTT GTA ACC TCC AAC ATC GCG TTG CTG CTG AAT CGA AAC AAT ATG GGA 17  
 Val Val Thr Ser Asn Ile Ala Leu Leu Leu Asn Arg Asn Asn Met Ala  
 255 260 265 270  
 GCC ATG GAT GAC GAT GTT CCT ATG ACA CAG AGC TTT GGA TGT GGA AGG 55  
 Ala Met Asp Asp Asp Val Pro Met Thr Gln Ser Phe Gly Cys Gly Ser  
 275 280 285  
 TAT GCT ATT TAGTAACTCG AG 886  
 Tyr Ala Ile 290

(2) INFORMATION FOR SEQ ID NO:4:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 289 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

Met Ile Arg Phe Leu Val Leu Ser Leu Leu Ile Leu Thr Leu Phe Leu  
 1 5 10 15  
 Thr Thr Pro Ala Val Glu Gly Asp Val Ser Phe Arg Leu Ser Gly Ala  
 20 25 30  
 Thr Ser Ser Ser Tyr Gly Val Phe Ile Ser Asn Leu Arg Lys Ala Leu  
 35 40 45  
 Pro Asn Glu Arg Lys Leu Tyr Asp Ile Pro Leu Leu Arg Ser Ser Leu  
 50 55 60  
 Pro Gly Ser Gln Arg Tyr Ala Leu Ile His Leu Thr Asn Tyr Ala Asp  
 65 70 75 80

*Handwritten signature: R. D.*

Glu	Thr	Ile	Ser	Val	Ala	Ile	Asp	Val	Thr	Asn	Val	Tyr	Ile	Met	Gly
				85						90				95	
Tyr	Arg	Ala	Gly	Asp	Thr	Ser	Tyr	Phe	Phe	Asn	Glu	Ala	Ser	Ala	Thr
			100					105					110		
Glu	Ala	Ala	Lys	Tyr	Val	Phe	Lys	Asp	Ala	Met	Arg	Lys	Val	Thr	Leu
			115				120					125			
Pro	Tyr	Ser	Gly	Asn	Tyr	Glu	Arg	Leu	Gln	Thr	Ala	Ala	Gly	Lys	Ile
			130				135					140			
Arg	Glu	Asn	Ile	Pro	Leu	Gly	Leu	Pro	Ala	Leu	Asp	Ser	Ala	Ile	Thr
145					150					155					160
Thr	Leu	Phe	Tyr	Tyr	Asn	Ala	Asn	Ser	Ala	Ala	Ser	Ala	Leu	Met	Val
				165					170					175	
Leu	Ile	Gln	Ser	Thr	Ser	Glu	Ala	Ala	Arg	Tyr	Lys	Phe	Ile	Glu	Gln
			180					185					190		
Gln	Ile	Gly	Lys	Arg	Val	Asp	Lys	Thr	Phe	Leu	Pro	Ser	Leu	Ala	Ile
		195					200					205			
Ile	Ser	Leu	Glu	Asn	Ser	Trp	Ser	Ala	Leu	Ser	Lys	Gln	Ile	Gln	Ile
		210				215					220				
Ala	Ser	Thr	Asn	Asn	Gly	Gln	Phe	Glu	Thr	Pro	Val	Val	Leu	Ile	Asn
225					230					235					240
Ala	Gln	Asn	Gln	Arg	Val	Met	Ile	Thr	Asn	Val	Asp	Ala	Gly	Val	Val
				245					250				255		
Thr	Ser	Asn	Ile	Ala	Leu	Leu	Leu	Asn	Arg	Asn	Asn	Met	Ala	Ala	Met
			260					265					270		
Asp	Asp	Asp	Val	Pro	Met	Thr	Gln	Ser	Phe	Gly	Cys	Gly	Ser	Tyr	Ala
		275					280					285			

Ile

(2) INFORMATION FOR SEQ ID NO: 5:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1452 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA (genomic)

101

(iii) HYPOTHETICAL: NO

(iv) ANTI-SENSE: NO

(vi) ORIGINAL SOURCE:  
(A) ORGANISM: Oryza sativa

(vii) IMMEDIATE SOURCE:  
(B) CLONE: alpha-amylase

(ix) FEATURE:  
(A) NAME/KEY: CDS (B) LOCATION: 12. .1316  
(B) LOCATION: 12. .1316

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 5:

CCTCGAGGTG C ATG CAG GTG CTG AAC ACC ATG GTG AAC A CAC TTC TTG 50  
Met Gln Val Leu Asn Thr Met Val Asn Lys His Phe Leu  
1 5 10

TCC CTT TCG GTC CTC ATC GTC CTC CTT GGC CTC TCC TCC AAC TTG AC 58  
Ser Leu Ser Val Leu Ile Val Leu Leu Gly Leu Ser Ser Asn Leu Thr  
15 20 25

GCC GGG CAA GTC CTG TTT CAG GGA TTC AAC TGG GAG TCG TGG AAG GAG 66  
Ala Gly Gln Val Leu Phe Gln Gly Phe Asn Trp Glu Ser Trp Lys Glu  
30 35 40 45

AAT GGC GGG TGG TAC AAC TTC CTG ATG GGC AAG GTG GAC GAC ATC GAG 74  
Asn Gly Gly Trp Tyr Asn Phe Leu Met Gly Lys Val Asp Asp Ile Ala  
50 55 60

GCA GCC GGC ATC ACC CAC GTC TGG CTC CCT CCG CCG TCT CAC TCT GAG 82  
Ala Ala Gly Ile Thr His Val Trp Leu Pro Pro Pro Ser His Ser Val  
65 70 75

GGC GAG CAA GGC TAC ATG CCT GGG CGG CTG TAC GAT CTG GAC GCG TCG 90  
Gly Glu Gln Gly Tyr Met Pro Gly Arg Leu Tyr Asp Leu Asp Ala Ser  
80 85 90

AAG TAC GGC AAC GAG GCG CAG CTC AAG TCG CTG ATC GAG GCG TTC CAG 98  
Lys Tyr Gly Asn Glu Ala Gln Leu Lys Ser Leu Ile Glu Ala Phe His  
95 100 105

GGC AAG GGC GTC CAG GTG ATC GCC GAC ATC GTC ATC AAC CAC CGC AC386  
 Gly Lys Gly Val Gln Val Ile Ala Asp Ile Val Ile Asn His Arg Thr  
 110 115 120 125  
 GCG GAG CAC AAG GAC GGC CGC GGC ATC TAC TGC CTC TTC GAG GGC GCG34  
 Ala Glu His Lys Asp Gly Arg Gly Ile Tyr Cys Leu Phe Glu Gly Gly  
 130 135 140  
 ACG CCC GAC TCC CGC CTC GAC TGG GGC CCG CAC ATG ATC TGC CGC GAC32  
 Thr Pro Asp Ser Arg Leu Asp Trp Gly Pro His Met Ile Cys Arg Asp  
 145 150 155  
 GAC CCC TAC GGC CAT GGC ACC GGC AAC CCG GAC ACC GGC GCC GAC TAC30  
 Asp Pro Tyr Gly Asp Gly Thr Gly Asn Pro Asp Thr Gly Ala Asp Phe  
 160 165 170  
 GCC GCC GCG CCG GAC ATC GAC CAC CTC AAC AAG CGC GTC CAG CGG GAC38  
 Ala Ala Ala Pro Asp Ile Asp His Leu Asn Lys Arg Val Gln Arg Glu  
 175 180 185  
 CTC ATT GGC TGG CTC GAC TGG CTC AAG ATG GAC ATC GGC TTC GAC GAC26  
 Leu Ile Gly Trp Leu Asp Trp Leu Lys Met Asp Ile Gly Phe Asp Ala  
 190 195 200 205  
 TGG CGC CTC GAC TTC GCC AAG GGC TAC TCC GCC GAC ATG GCA AAC AAC74  
 Trp Arg Leu Asp Phe Ala Lys Gly Tyr Ser Ala Asp Met Ala Lys Ile  
 210 215 220  
 TAC ATC GAC GCC ACC GAG CCG AGC TTC GCC GTG CCC GAG ATA TCG AAC22  
 Tyr Ile Asp Ala Thr Glu Pro Ser Phe Ala Val Ala Glu Ile Trp Thr  
 225 230 235  
 TCC ATG GCG AAC GGC GGG GAC GGC AAG CCG AAC TAC GAC CAG AAC GCG70  
 Ser Met Ala Asn Gly Gly Asp Gly Lys Pro Asn Tyr Asp Gln Asn Ala  
 240 245 250  
 CAC CGG CAC GAG CTG GTC AAC TGG GTC GAT CGT GTC GGC GGC GCC AAC18  
 His Arg Gln Glu Leu Val Asn Trp Val Asp Arg Val Gly Gly Ala Asn  
 255 260 265  
 ACC AAC GGC ACG GCG TTC GAC TTC ACC ACC AAG GGC ATC CTC AAC GAC56



Ser Asn Gly Thr Ala Phe Asp Phe Thr Thr Lys Gly Ile Leu Asn Val  
 270 275 280 285  
 GCC GTG GAG GGC GAG CTG TGG CGC CTC CGC GGC GAG GAC GGC AAG GCG  
 Ala Val Glu Gly Glu Leu Trp Arg Leu Arg Gly Glu Asp Gly Lys Ala  
 290 295 300  
 CCC GGC ATG ATC GGG TGC TGG CCG GCC AAG GCG ACG ACC TTC GTC GAG  
 Pro Gly Met Ile Gly Trp Trp Pro Ala Lys Ala Thr Thr Phe Val Asp  
 305 310 315  
 AAC CAC GAC ACC GGC TCG ACG CAG CAC CTG TGG CCG TTC CCC TCC GAG  
 Asn His Asp Thr Gly Ser Thr Gln His Leu Trp Pro Phe Pro Ser Asp  
 320 325 330  
 AAG GTC ATG CAG GGC TAC GCA TAC ATC CTC ACC CAC CCC GGC AAC CCG  
 Lys Val Met Gln Gly Tyr Ala Tyr Ile Leu Thr His Pro Gly Asn Pro  
 335 340 345  
 TGC ATC TTG TAC GAC CAT TTC TTC GAT TGG GGT CTC AAG GAG GAG ATT  
 Cys Ile Phe Tyr Asp His Phe Phe Asp Trp Gly Leu Lys Glu Glu Ile  
 350 355 360 365  
 GAG CGC CTG GTG TCA ATC AGA AAC CGG CAG GGG ATC CAC CCG GCG AGC  
 Glu Arg Leu Val Ser Ile Arg Asn Arg Gln Gly Ile His Pro Ala Ser  
 370 375 380  
 GAG CTG CGC ATC ATG GAA GCT GAC AGC GAT CTC TAC CTC GCG GAG ATT  
 Glu Leu Arg Ile Met Glu Ala Asp Ser Asp Leu Tyr Leu Ala Glu Ile  
 385 390 395  
 GAT GGC AAG GTG ATC ACA AAG ATT GGA CCA AGA TAC GAC GTC GAA GAG  
 Asp Gly Lys Val Ile Thr Lys Ile Gly Pro Arg Tyr Asp Val Glu His  
 400 405 410  
 CTC ATC CCC GAA GGC TTC CAG GTC GTC GCG CAC GGT GAT GGC TAC GCG  
 Leu Ile Pro Glu Gly Phe Gln Val Val Ala His Gly Asp Gly Tyr Ala  
 415 420 425  
 ATC TGG GAG AAA ATC TGAGCGCACG ATGACGAGAC TCTCAGTTTA GCAGATTTA  
 Ile Trp Glu Lys Lie  
 430 435

CCTGCGATTT TTACCCTGAC CGGTATACGT ATATACGTGC CGGCAACGAG 1413  
CTGTATCCGA

TCCGAATTAC GGATGCAATT GTCCACGAAG TCCTCGAGG 1452

(2) INFORMATION FOR SEQ ID NO: 6:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 434 amino acids
- (B) TYPE: amino acid
- (D) Topology: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 6:

Met	Gln	Val	Leu	Asn	Thr	Met	Val	Asn	Lys	His	Phe	Leu	Ser	Leu	Ser	1	5	10	15
Val	Leu	Ile	Val	Leu	Leu	Gly	Leu	Ser	Ser	Asn	Leu	Thr	Ala	Gly	Gln	20	25	30	
Val	Leu	Phe	Gln	Gly	Phe	Asn	Trp	Glu	Ser	Trp	Lys	Glu	Asn	Gly	Gly	35	40	45	
Trp	Tyr	Asn	Phe	Leu	Met	Gly	Lys	Val	Asp	Asp	Ile	Ala	Ala	Ala	Gly	50	55	60	
Ile	Thr	His	Val	Trp	Leu	Pro	Pro	Pro	Ser	His	Ser	Val	Gly	Glu	Gln	65	70	75	80
Gly	Tyr	Met	Pro	Gly	Arg	Leu	Tyr	Asp	Leu	Asp	Ala	Ser	Lys	Tyr	Gly	85	90	95	
Asn	Glu	Ala	Gln	Leu	Lys	Ser	Leu	Ile	Glu	Ala	Phe	His	Gly	Lys	Gly	100	105	110	
Val	Gln	Val	Ile	Ala	Asp	Ile	Val	Ile	Asn	His	Arg	Thr	Ala	Glu	His	115	120	125	
Lys	Asp	Gly	Arg	Gly	Ile	Tyr	Cys	Leu	Phe	Glu	Gly	Gly	Thr	Pro	Asp	130	135	140	
Ser	Arg	Leu	Asp	Trp	Gly	Pro	His	Met	Ile	Cys	Arg	Asp	Asp	Pro	Tyr	145	150	155	160
Gly	Asp	Gly	Thr	Gly	Asn	Pro	Asp	Thr	Gly	Ala	Asp	Phe	Ala	Ala	Ala	165	170	175	

105

Pro Asp Ile Asp His Leu Asn Lys Arg Val Gln Arg Glu Leu Ile Gly  
180 185 190

Trp Leu Asp Trp Leu Lys Met Asp Ile Gly Phe Asp Ala Trp Arg Leu  
195 200 205

Asp Phe Ala Lys Gly Tyr Ser Ala Asp Met Ala Lys Ile Tyr Ile Asp  
210 215 220

Ala Thr Glu Pro Ser Phe Ala Val Ala Glu Ile Trp Thr Ser Met Ala  
225 230 235 240

Asn Gly Gly Asp Gly Lys Pro Asn Tyr Asp Gln Asn Ala His Arg Gln  
245 250 255

Glu Leu Val Asn Trp Val Asp Arg Val Gly Gly Ala Asn Ser Asn Gly  
260 265 270

Thr Ala Phe Asp Phe Thr Thr Lys Gly Ile Leu Asn Val Ala Val Glu  
275 280 285

Gly Glu Leu Trp Arg Leu Arg Gly Glu Asp Gly Lys Ala Pro Gly Met  
290 295 300

Ile Gly Trp Trp Pro Ala Lys Ala Thr Thr Phe Val Asp Asn His Asp  
305 310 315 320

Thr Gly Ser Thr Gln His Leu Trp Pro Phe Pro Ser Asp Lys Val Met  
325 330 335

Gln Gly Tyr Ala Tyr Ile Leu Thr His Pro Gly Asn Pro Cys Ile Phe  
340 345 350

Tyr Asp His Phe Phe Asp Trp Gly Leu Lys Glu Glu Ile Glu Arg Leu  
355 360 365

Val Ser Ile Arg Asn Arg Gln Gly Ile His Pro Ala Ser Glu Leu Arg  
370 375 380

Ile Met Glu Ala Asp Ser Asp Leu Tyr Leu Ala Glu Ile Asp Gly Lys  
385 390 395 400

Val Ile Thr Lys Ile Gly Pro Arg Tyr Asp Val Glu His Leu Ile Pro  
405 410 415

Glu Gly Phe Gln Val Val Ala His Gly Asp Gly Tyr Ala Ile Trp Glu  
420 425 430

Lys Ile

(2) INFORMATION FOR SEQ ID NO:7:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 709 base pairs
- (B) TYPE: nucleic acid
- (G) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA to mRNA

(iii) HYPOTHETICAL: NO

(iv) ANTI-SENSE: NO

(vi) ORIGINAL SOURCE:

(A) ORGANISM: Homo sapiens

(vii) IMMEDIATE SOURCE:

(B) CLONE: alpha-hemoglobin

(ix) FEATURE:

- (A) NAME/KEY: transit\_peptide (B) LOCATION: 26. .241
- (B) LOCATION: 26. .241

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 245. .670

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 7:

CTCGAGGGCA TCTGATCTTT CAAGAATGGC ACAAATTAAC AACATGGCAC  
AAGGGATACA 60

AACCCTTAAT CCCAATTCCA ATTTCCATAA ACCCCAAGTT CCTAAATCTT  
CAAGTTTCT 120

TGTTTTTGGA TGTA AAAAAC TGAA AATTC AGCAAATTCT ATGTTGGTTT TGAAAAAAGG

TTCAATTTTT ATGCAAAAGT TTTGTTCTT TAGGATTTC GCAGGTGGTA  
GATTTCTTG 240

CATG GTG CTG TCT CCT GCC GAC AAG ACC AAC GTC AAG GCC GCC TGG GGC  
289

Val Leu Ser Pro Ala Asp Lys Thr Asn Val Lys Ala Ala Trp Cys  
1 5 10 15

AAG GTT GGC GCG CAC GCT GGC GAG TAT GGT GCG GAG GCC CTG GAG AGG 37

Lys Val Gly Ala His Ala Gly Glu Tyr Gly Ala Glu Ala Leu Glu Arg  
20 25 30

ATG TTC CTG TCC TTC CCC ACC ACC AAG ACC TAC TTC CCG CAC TTC GAG 85  
Met Phe Leu Ser Phe Pro Thr Thr Lys Thr Tyr Phe Pro His Phe Asp  
35 40 45  
CTG AGC CAC GGC TCT GCC CAG GTT AAG GGC CAC GGC AAG AAG GTG GAG 93  
Leu Ser His Gly Ser Ala Gln Val Lys Gly His Gly Lys Lys Val Ala  
50 55 60  
GAC GCG CTG ACC AAC GCC GTG GCG CAC GTG GAC GAC ATG CCC AAC GAG 101  
Asp Ala Leu Thr Asn Ala Val Ala His Val Asp Asp Met Pro Asn Ala  
65 70 75  
CTG TCC GCC CTG AGC GAC CTG CAC GCG CAC AAG CTT CGG GTG GAC CAG 109  
Leu Ser Ala Leu Ser Asp Leu His Ala His Lys Leu Arg Val Asp Pro  
80 85 90 95  
GTC AAC TTC AAG CTC CTA AGC CAC TGC CTG CTG GTG ACC CTG GCC GAG 117  
Val Asn Phe Lys Leu Leu Ser His Cys Leu Leu Val Thr Leu Ala Ala  
100 105 110  
CAC CTC CCC GCC GAG TTC ACC CCT GCG GTG CAC GCC TCC CTG GAC AAG 125  
His Leu Pro Ala Glu Phe Thr Pro Ala Val His Ala Ser Leu Asp Lys  
115 120 125  
TTC CTG GCT TCT GTG AGC ACC GTG CTG ACC TCC AAA TAC CGT  
TAAGCTGGAG 677  
Phe Leu Ala Ser Val Ser Thr Val Leu Thr Ser Lys Tyr Arg  
130 135 140  
CCTCGGTAGC CGTTCCTCCT GCCCGGTCGA CC

(2) INFORMATION FOR SEQ ID NO:8:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 141 amino acids  
(B) TYPE: amino acid  
(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(ix) SEQUENCE DESCRIPTION: SEQ ID NO:8:

108

Val Leu Ser Pro Ala Asp Lys Thr Asn Val Lys Ala Ala Trp Gly Lys  
1 5 10 15  
Val Gly Ala His Ala Gly Glu Tyr Gly Ala Glu Ala Leu Glu Arg Met  
20 25 30  
Phe Leu Ser Phe Pro Thr Thr Lys Thr Tyr Phe Pro His Phe Asp Leu  
35 40 45  
Ser His Gly Ser Ala Gln Val Lys Gly His Gly Lys Lys Val Ala Asp  
50 55 60  
Ala Leu Thr Asn Ala Val Ala His Val Asp Asp Met Pro Asn Ala Leu  
65 70 75 80  
Ser Ala Leu Ser Asp Leu His Ala His Lys Leu Arg Val Asp Pro Val  
85 90 95  
Asn Phe Lys Leu Leu Ser His Cys Leu Leu Val Thr Leu Ala Ala His  
100 105 110  
Leu Pro Ala Glu Phe Thr Pro Ala Val His Ala Ser Leu Asp Lys Phe  
115 120 125  
Leu Ala Ser Val Ser Thr Val Leu Thr Ser Lys Tyr Arg  
130 135 140

(2) INFORMATION FOR SEQ ID NO:9:

- (i) SEQUENCE CHARACTERISTICS:  
(A) LENGTH: 743 base pairs  
(B) TYPE: nucleic acid  
(C) STRANDEDNESS: single  
(D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: cDNA to mRNA
- (iii) HYPOTHETICAL: NO
- (iv) ANTI-SENSE: NO
- (vi) ORIGINAL SOURCE:  
(A) ORGANISM: Homo sapiens
- (vii) IMMEDIATE SOURCE:  
(B) CLONE: beta-hemoglobin
- (ix) FEATURE:  
(A) NAME/KEY: transit\_peptide (B) LOCATION:  
26. .241

(B) LOCATION: 26..241

(ix)

FEATURE:

(A) NAME/KEY: CDS

(B) LOCATION: 245..685

(xi)

SEQUENCE DESCRIPTION: SEQ ID NO: 9:

CTCGAGGGGA TCTGATCTTT CAAGAATGGC ACAAATTAAC AACATGGCAC 60  
AAGGGATACA

AACCCTTAAT CCCAATTCCA ATTTCCATAA ACCCCAAGTT CCTAAATCTT 120  
CAAGTTTTCT

TGTTTTTGGG TCTAAAAAAC TGAAAAATTC AGCAAATTCT ATGTTGGTTT 180  
TGAAAAAGA

TTCAATTTTT ATGCAAAAGT TTTGTTCTT TAGGATTTCG GCAGGTGGTA 240  
GAGTTTCTTG

GATG GTG CAC CTG ACT CCT GAG GAG AAG TCT GCC GTT ACT GCC CTG TGG 289  
289

Val His Leu Thr Pro Glu Glu Lys Ser Ala Val Thr Ala Leu Trp  
1 5 10 15

GGC AAG GTG AAC GTG GAT GAA GTT GGT GGT GAG GCC CTG GGC AGG CTG 37  
Gly Lys Val Asn Val Asp Glu Val Gly Gly Glu Ala Leu Gly Arg Leu  
20 25 30

CTG GTG GTC TAC CCT TGG ACC CAG AGG TTC TTT GAG TCC TTT GGC GAG 35  
Leu Val Val Tyr Pro Trp Thr Gln Arg Phe Phe Glu Ser Phe Gly Asp  
35 40 45

CTG TCC ACT CCT GAT GCT GTT ATG GGC AAC CCT AAG GTG AAG GCT CAG 33  
Leu Ser Thr Pro Asp Ala Val Met Gly Asn Pro Lys Val Lys Ala His  
50 55 60

GGC AAG AAA GTG CTG GGT GCC TTT AGT GAT GGC CTG GCT CAC CTG GAG 31  
Gly Lys Lys Val Leu Gly Ala Phe Ser Asp Gly Leu Ala His Leu Asp  
65 70 75

AAC CTC AAG GGC ACC TTT GCC ACCA CTG AGT GAG CTG CAC TGT GAC AAG 529  
529

Asn Leu Lys Gly Thr Phe Ala Thr Leu Ser Glu Leu His Cys Asp Lys  
80 85 90 95

116

CTG CAC GTG GAT CCT GAG AGC TTC AGG CTC CTA GGC AAC GTG CTG GTC 7  
 Leu His Val Asp Pro Glu Ser Phe Arg Leu Leu Gly Asn Val Leu Val  
 100 105 110  
 TGT GTG CTG GCG CAT CAC TTT GGC AAA GAA TTC ACC CCA CCA GTG CAC 25  
 Cys Val Leu Ala His His Phe Gly Lys Glu Phe Thr Pro Pro Val Gln  
 115 120 125  
 GCT GCC TAT CAG AAA GTG GTG GCT GGT GTG GCT AAT GCC CTG GCC CAC 73  
 Ala Ala Tyr Gln Lys Val Val Ala Gly Val Ala Asn Ala Leu Ala His  
 130 135 140  
 AAG TAT CAC TAAGCTCGCT TTCTTGCTGT CCAATTTCTA TTAAAGGTTC 722  
 Lys Tyr His  
 145  
 CTTTGTGGGG TCGAGGTCGA C 743

(2) INFORMATION FOR SEQ ID NO: 10:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 146 amino acids  
 (B) TYPE: amino acid  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 10:

Val His Leu Thr Pro Glu Glu Lys Ser Ala Val Thr Ala Leu Trp Gly  
 1 5 10 15  
 Lys Val Asn Val Asp Glu Val Gly Gly Glu Ala Leu Gly Arg Leu Leu  
 20 25 30  
 Val Val Tyr Pro Trp Thr Gln Arg Phe Phe Glu Ser Phe Gly Asp Leu  
 35 40 45  
 Ser Thr Pro Asp Ala Val Met Gly Asn Pro Lys Val Lys Ala His Gly  
 50 55 60  
 Lys Lys Val Leu Gly Ala Phe Ser Asp Gly Leu Ala His Leu Asp Asn  
 65 70 75 80  
 Leu Lys Gly Thr Phe Ala Thr Leu Ser Glu Leu His Cys Asp Lys Leu  
 85 90 95



His Val Asp Pro Glu Ser Phe Arg Leu Leu Gly Asn Val Leu Val Cys  
100 105 110

Val Leu Ala His His Phe Gly Lys Glu Phe Thr Pro Pro Val Gln Ala  
115 120 125

Ala Tyr Gln Lys Val Val Ala Gly Val Ala Asn Ala Leu Ala His Lys  
130 135 140

Tyr His  
145

(2) INFORMATION FOR SEQ ID NO:11:

(i) SEQUENCE CHARACTERISTICS:  
(A) LENGTH: 17 amino acids  
(B) TYPE: amino acid  
(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: peptide

(v) FRAGMENT TYPE: N-terminal

(vi) ORIGINAL SOURCE:  
(A) ORGANISM: alkalophilic Bacillus sp.  
(B) STRAIN: 38-2

(vii) IMMEDIATE SOURCE:  
(B) CLONE: beta-cyclodextrin

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 11:

Ala Pro Asp Thr Ser Val Ser Asn Lys Gln Asn Phe Ser Thr Asp Val  
1 5 10 15

Ile

112